



Supporting Online Material for

Wireless Power Transfer via Strongly Coupled Magnetic Resonances

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SOM Text

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Effect of using capacitively-loaded loops and lowering the operating frequency on field strengths and power levels

As stated in the text, capacitively-loaded loops generate significantly lower electric fields in the space surrounding the objects than self-resonant coils. We have performed calculations to simulate a transfer of 60W across two identical capacitively-loaded loops (6) similar in dimension to our self-resonant coils (radius of loop 30cm, cross sectional radius of the conductor 3cm, and distance between the loops of 2m), and calculated the maximum values of the fields and Poynting vector 20cm away from the device loop.

Frequency (MHz)	η	E_{rms} (V/m)	H_{rms} (A/m)	S_{rms} (W/cm ²)	Power radiated (W)
10	83%	185	21	0.08	3.3
1	60%	40	14	0.04	0.005

At 10MHz, note the significant reduction in the electric field strength with respect to the self-resonant coils. Lowering the operating frequency down to 1MHz further reduces the electric field, Poynting vector, and power radiated. At 1MHz, all our fields are below IEEE safety guidelines (18) ($E_{rms} = 614\text{V/m}$, $H_{rms} = 16.3\text{A/m}$, and $S_{rms} = 0.1\text{W/cm}^2$ at 1MHz.)

Figures

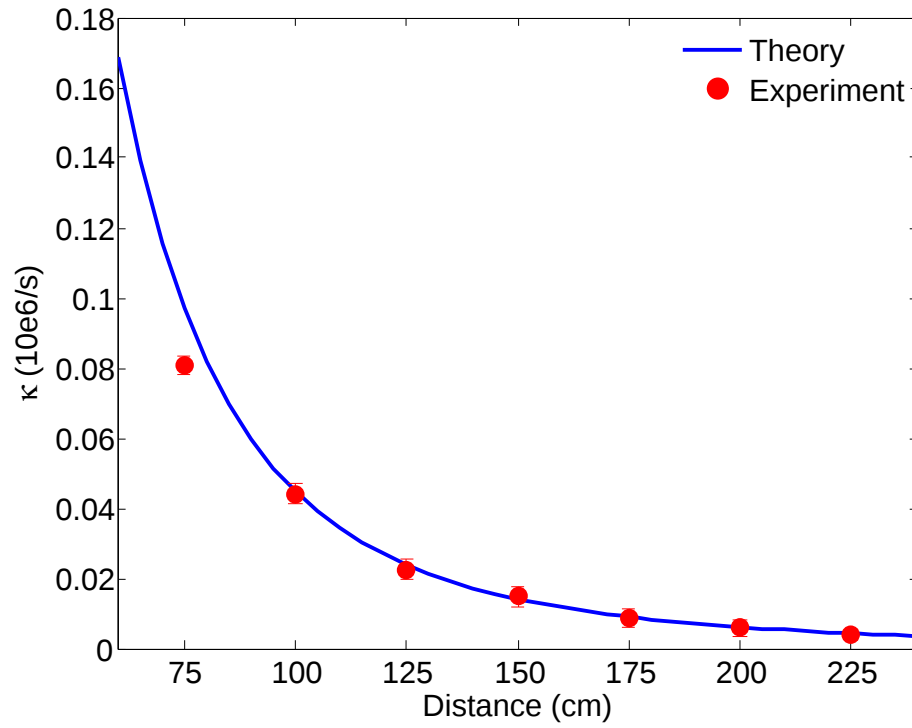


Figure 1: Theoretical and experimental κ as a function of distance when one of the coils is rotated by 45% with respect to coaxial alignment.

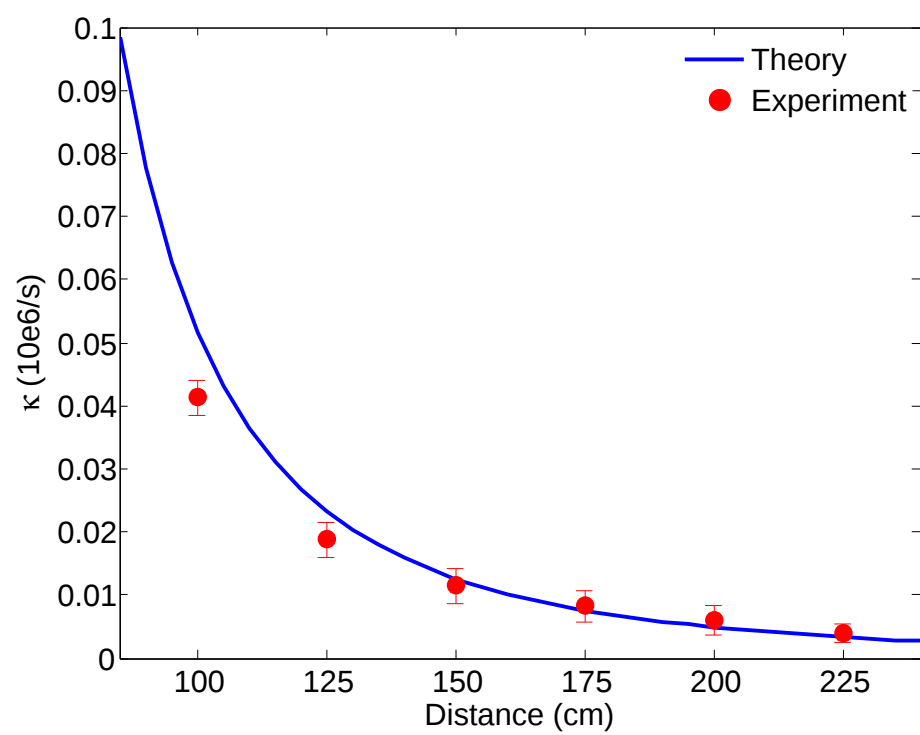


Figure 2: Theoretical and experimental κ as a function of distance when the coils are coplanar.

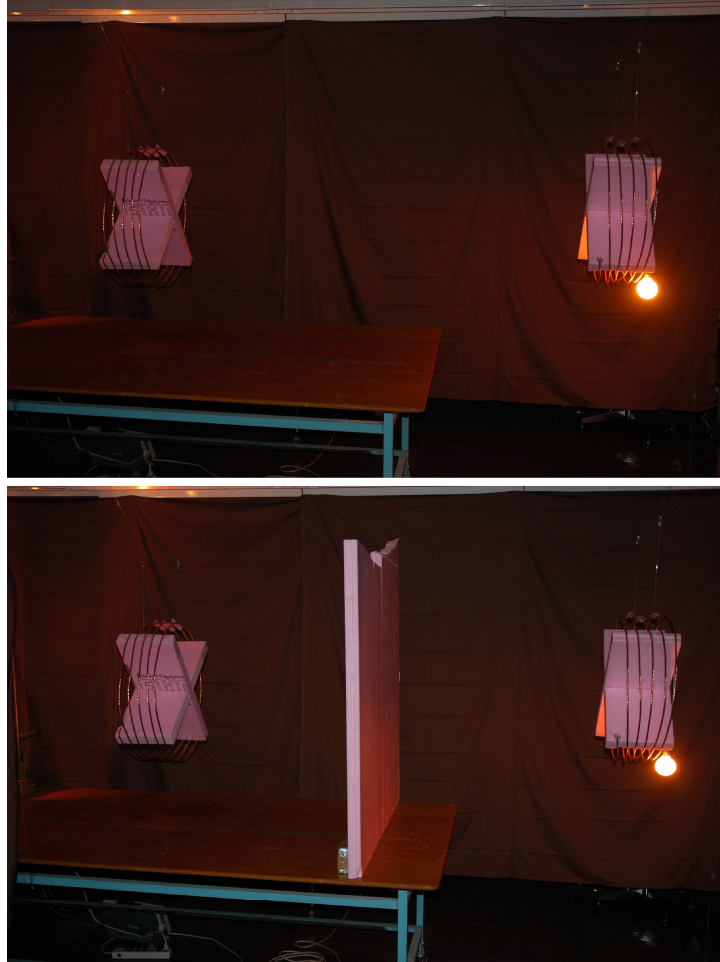


Figure 3: 60W light-bulb being lit from 2m away. Note the obstruction in the lower image.

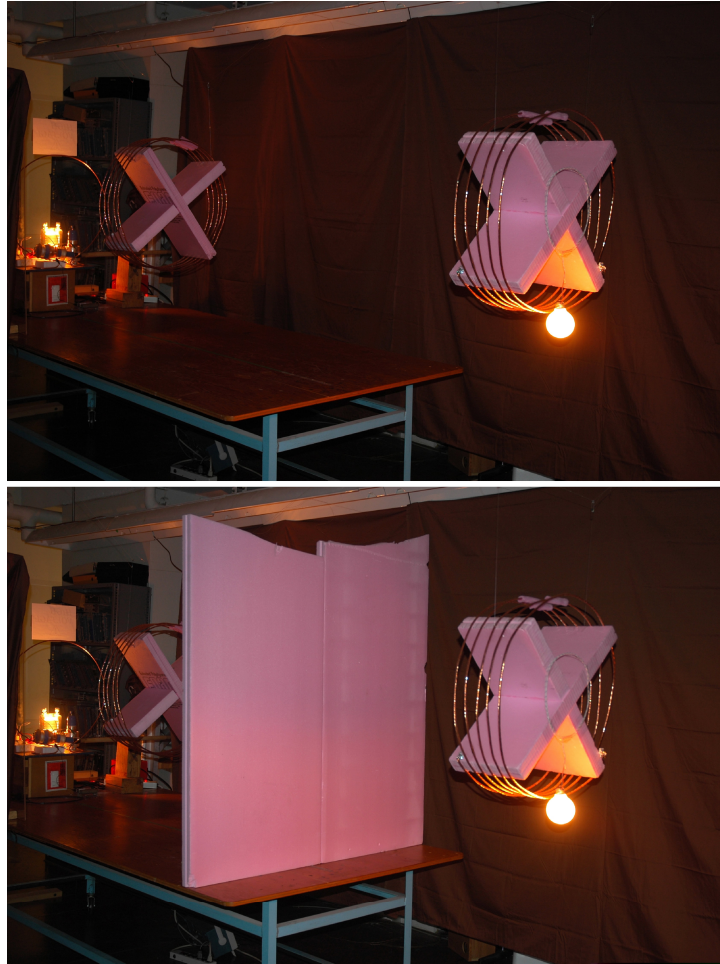


Figure 4: 60W light-bulb. Alternate angle.

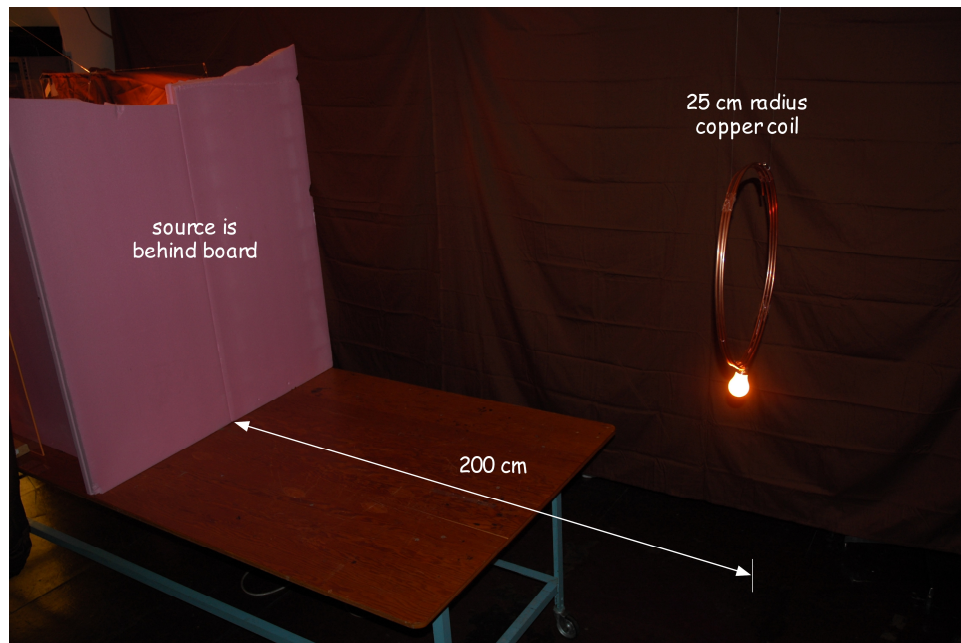


Figure 5: Alternative geometry.